Before the
**FEDERAL COMMUNICATIONS COMMISSION**
Washington, DC 20554

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| In the Matter of | ) | |
| | ) | |
| Amendment of the Commission's Rules to | ) | |
| Establish a Next-Generation Air-Ground | ) | RM-11640 |
| Communications Service on a Secondary | ) | |
| Licensed Basis in the 14.0-14.5 GHz Band | ) | |

# REPLY COMMENTS OF THE BOEING COMPANY

The Boeing Company ("Boeing") provides the following reply comments in response to the May 15, 2012 Public Notice ("Notice")[1] seeking comment on the technical information provided by Qualcomm, Incorporated ("Qualcomm") regarding the above-captioned Petition for Rulemaking (together with supplementary information, the "Petition").[2]

Boeing does not believe that the information presented by Qualcomm is sufficient to resolve lingering questions regarding the technical challenges posed by a new Air-to-Ground

[1] *International Bureau Seeks Further Comment on Qualcomm Petition for Rulemaking*, Public Notice, DA 12-767 (rel. May 15, 2012). The comment date was extended by the Commission to July 16, 2012 in response to a petition from Satellite Industry Association ("SIA"). *See Letter of James L. Ball, Chief, Policy Division, International Bureau, Federal Communications Commission, to Patricia Cooper, President, Satellite Industry Association*, DA 12-835 (May 25, 2012).

[2] *Petition for Rulemaking in the Matter of Amendment of the Commission's Rules to Establish a Next-Generation Air-Ground Communications Service on a Secondary Licensed Basis in the 14.0 to 14.5 GHz Band*, RM-11640 (filed July 7, 2011); *Letter from Dean R. Brenner, Vice President, Qualcomm, to James Ball, Chief, Policy Division, International Bureau*, RM-11640 (filed Jan. 30, 2012); *Letter from Dean R. Brenner, Vice President, Qualcomm, to James Ball, Chief, Policy Division, International Bureau*, RM-11640 (filed Mar. 29, 2012); *Letter from Dean R. Brenner, Vice President, Qualcomm, to James Ball, Chief, Policy Division, International Bureau*, RM-11640 (filed Apr. 6, 2012).

("ATG") service in the 14.0-15.5 GHz band, or to justify initiation of a rulemaking to allow such a new service. Specifically, Boeing believes that gaps and inconsistencies in the technical information cast doubt on an ATG system's ability to protect and tolerate interference from existing Fixed Satellite Service ("FSS") operations and future Non-Geostationary Satellite Orbit ("NGSO") operations in the band. Boeing also notes that the Petition focuses on the intensively used 14.0-14.5 GHz band in disregard of plausible alternative bands, including the similarly-allocated and under-used High Altitude Platform Station ("HAPS") spectrum at 47 GHz. For these reasons, Boeing believes that the initiation of a rulemaking proceeding on Qualcomm's ATG service is not warranted at this time.

## I. THE PETITION DOES NOT ADEQUATELY ADDRESS THE POTENTIAL FOR INTERFERENCE IN THE 14.0-14.5 GHz BAND

The introduction of a new, terrestrial ATG service into a band already intensively used by the satellite industry could significantly impact existing and future services, and ATG interference into these services may be significantly worse than Qualcomm assumed in its Petition. Additionally, Qualcomm has not adequately shown that an ATG service in the band could tolerate interference it receives from existing operations.

In petitioning the Commission to initiate a rulemaking proceeding – not to mention in proposing a new allocation in a crowded band – Qualcomm bears the legal burden of providing "sufficient reason" to justify initiation of a proceeding,[3] as well as the logical burden of fully explaining how such a service is consistent with the protection and growth of existing services. The Commission has confronted this issue before, when "insufficient technical information" in the record of the 2004 ATG proceeding precluded a determination as to the risk of harmful

[3] 47 C.F.R. § 1.407.

interference posed by cellular phones aboard aircraft.[4] Absent such information, a decision on whether to allow such a service would be "premature."[5] Although several commenters have indicated significant shortcomings in Qualcomm's proposal, Qualcomm has not provided information sufficient to address these concerns.

### A. The Petition Does Not Provide Sufficient Information to Allay Serious Concerns about Interference to Existing Services in the 14.0-14.5 Band

It is not clear at all that the Petition presents an accurate enough assessment of potential interference into primary FSS operations for the Commission to fully consider the impact of adding a secondary service to the band.[6] For instance, the Petition assumes uniform spacing of 150 to 250 ground stations, but, as Boeing and Row 44, Inc. ("Row 44") have both noted, such uniform layout ignores numerous factors affecting placement of ground stations, chief among them that air traffic will be concentrated over and between areas of higher population density.[7] Although Qualcomm proposes to point its ground stations north to avoid interfering with geostationary ("GSO") satellites over the equator, such an orientation does not protect NGSO satellites flying through ATG beams. Others have noted that despite a north-facing installation,

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[4] *Amendment of the Commission's Rules to Facilitate the Use of Cellular Telephones and Other Wireless Devices Aboard Airborne Aircraft, WT Docket No. 04-435*, Memorandum Opinion and Order, FCC 07-47, ¶ 3 (rel. Apr. 3, 2007).

[5] *Id.*

[6] *Comments of The Boeing Company*, RM-11640, IB Docket No. 05-20 at 2-3 (filed Sept. 29, 2011) ("*Boeing Comments*").

[7] *Comments of Row 44*, RM-11640, IB Docket No. 05-20 at 3 (filed July. 16, 2012) ("*Row 44 Comments*"); *Boeing Comments* at 2; *see also Alcatel-Lucent Comments* at 5 (cautioning that the number and distribution of ground stations could differ substantially from Qualcomm's predictions).

"atmospheric conditions could re-radiate significant amounts of energy via reflection from, for example, ice crystals and snowflakes."[8]

Addition of a new service, particularly without the benefit of a reliable and detailed analysis of its interference potential, could cause serious harm to existing operations. For instance, one of the primary benefits of the Aeronautical Mobile-Satellite Service ("AMSS") for in-flight communications is its reliability. Boeing operates an AMSS network that serves the critical communications needs of the highest levels of the federal government. Operation of an ATG system is likely to raise the noise floor in the band significantly, slowing and degrading operations, particularly to AMSS operations near the edge of satellite beam coverage where link budgets are already very tight.[9] Boeing is not convinced that the mitigation techniques discussed by Qualcomm are sufficient to prevent interference to existing services and therefore does not recommend that the Commission initiate a rulemaking proceeding.

### B. The Petition Does Not Establish that the Proposed ATG Service Could Tolerate Interference Commensurate With Secondary Status in an Intensively Used Band

Qualcomm's Petition does not adequately establish that its new secondary service could tolerate interference from existing satellite operations in the band, particularly sharing with relatively new satellite services such as Earth Stations onboard Vessels ("ESV"), Vehicle-Mounted Earth Stations ("VMES"), and AMSS. The Commission has cautioned against

[8] *Row 44 Comments* at 5 (citing S.Y. Matrosov, "Radar Reflectivity in Snowfall," IEEE Transactions on Geoscience and Remote Sensing," Vol. 30, No. 3, at 454-61 (May 1992)).

[9] *Id.* at 4.

introducing new services into a band shortly after the introduction of other new services.[10] As SIA explained in its comments, Qualcomm's technical data leaves many questions about the ability of its proposed ATG system to withstand interference from primary users.[11] Qualcomm explains that it will increase rejection in its antenna patterns or change frequencies, but this explanation, without more, is insufficient to invite confidence in the system's robustness. Moreover, such an avoidance approach is likely untenable in the face of increasing usage from both mobile terrestrial sources (FSS, ESV, VMES) and mobile aeronautical sources (AMSS). Indeed, AMSS continues to increase, even before the Commission's AMSS rulemaking proceeding has concluded.[12] AMSS operations are likely to increase even more rapidly upon adoption of AMSS rules.

A secondary allocation in a band that is already intensively used and becoming more so risks burdensome regulatory confrontations in the future, as new entrants, particularly those that have purchased spectrum at auction or built business models around the spectrum, would be motivated to seek increasing protections beyond secondary status. Such proceedings would cause significant added complication to a band that is already subject to complex regulations as

[10] *See, e.g., Amendment of the Commission's Rules to Provide Ancillary Services in the 849-851 and 894-896 MHz Bands,* RM No. 7871, Order, 8 FCC Red 3920 (rel. June 4, 1993) (petition for rulemaking is premature where limited experience with recently established services created uncertainty whether new secondary service could operate effectively on shared frequencies and not adversely impact growth and development of the primary service); *Boeing Comments* at 3.

[11] *Comments of the Satellite Industry Association*, RM-11640 at 11-12 (filed July 16, 2012) ("*SIA Comments*").

[12] *Service Rules and Procedures To Govern the Use of Aeronautical Mobile Satellite Service Earth Stations in Frequency Bands Allocated to the Fixed Satellite Service, IB Docket No. 05-02*, Notice of Proposed Rulemaking, FCC 05-14 (rel. Feb. 9, 2005).

well as compromising the growth of all services involved due to the cost, time, and uncertainty involved in a protracted regulatory dispute.

### C. The Qualcomm Proposal May Preclude Future Ku-Band NGSO FSS Systems

In addition to affecting GSO FSS systems, Qualcomm's proposed system is likely to seriously hinder the development of future NGSO FSS systems in the Ku-band. Because the Commission has allocated the Ku-band for co-frequency NGSO FSS services, secondary services in the band, such as Qualcomm's proposed ATG service, must be designed to accept interference from future such systems. They must be equally prepared to protect these systems from interference. The data provided by Qualcomm does not provide sufficient evidence to conclude that its proposed ATG system can achieve either of these requirements.

SIA noted in its comments that the Petition did not provide antenna patterns for its ground stations or aircraft stations, and provided inconsistent responses regarding other technical characteristics, making any evaluation of the interference potential of Qualcomm's proposed service highly speculative at best.[13] Alcatel-Lucent observes that Qualcomm's proposed mitigation techniques of reducing transmit power when NGSO satellites pass near target aircraft is unreliable because it assumes timely and accurate ephemeris information for all NGSO satellites, which is unlikely to be available consistently.[14] Additionally, the NGSO allocation is international, meaning that, even assuming successful integration of ATG operations into U.S.

[13] *SIA Comments* at 11.

[14] Comments of Alcatel-Lucent, RM-11640 at 5-6 (filed Sept. 11, 2011) ("*Alcatel-Lucent Comments*"); *Qualcomm Petition* at A-2.

operations in the band, such operations could adversely affect the NGSO services of foreign countries.[15]

The Ku-band is already encumbered by the need to coordinate multiple dissimilar services such as FSS, AMSS, radio astronomy, and space research. The arrival of interference-protected NGSO systems would increase the complexity still further, and the information provided in the Petition offers little basis for concluding that Qualcomm's proposed ATG system is technically capable of accepting interference and protecting primary services as required.

## II. QUALCOMM'S PETITION DOES NOT ADEQUATELY CONSIDER ALTERNATE SPECTRUM

Qualcomm's petition provides only a perfunctory analysis of the viability of using other spectrum for its proposed expansion of ATG service. Such a scant review of other possibilities is inconsistent with Section 1.407 of the Commission's rules, which requires justification for the initiation of a particular rulemaking, as well as being contrary to the recommendations of commenters to this proceeding. Observing that "any rulemaking proceeding should not prejudge the specific frequency and bandwidth," Alcatel-Lucent noted in its comments that "unleashing stranded spectrum is preferable to sharing spectrum that is currently heavily used."[16] Boeing agrees that all options should be considered, and that options that enable the growth of ATG without compromising existing services should be strongly considered.

### A. Additional Spectrum is Required to Foster the Growth of ATG Service

The shortcomings of Qualcomm's petition do not detract from the long-term need for additional spectrum to accommodate the growth of ATG. As Qualcomm and others note, ATG

[15] 47 C.F.R. § 2.106.

[16] *Alcatel-Lucent Comments* at 4.

has significant promise to serve the demand for connectivity of an increasingly mobile and connected populace.[17] Despite the current slow growth of in-flight data usage, commenters and industry analysts expect a dramatically increased adoption rate as the technology matures.[18] Many entities in addition to Qualcomm are also developing ATG offerings, and the increase in competition and economies of scale is likely to reduce the price of ATG systems while driving usage. The growth of ATG should not, however, come at the expense of existing services, especially when there are other viable spectrum options that remain unconsidered. For this reason, although Boeing supports the growth of ATG, Boeing does not believe that the 14.0-14.5 GHz band is a wise or sustainable allocation for these operations.

### B. HAPS Band Spectrum is a Natural Choice for Expanding ATG Service

The 47 GHz HAPS band is intended for the use of high altitude, edge-of-space aerial stations such as balloons and light aircraft to facilitate delivery of advanced telecommunications at ground level, but HAPS has thus far gone largely unused in the United States.[19] The air-to-ground operating principle of HAPS is very similar to that of ATG. This similarity, combined with the current low utilization of the HAPS spectrum, makes HAPS a strong candidate for expansion of ATG service.

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[17] *Alcatel-Lucent Comments* at 3; *Petition* at 3.

[18] *See e.g. Alcatel Lucent Comments* at 3; Tammy Parker, In-Stat: Market for in-flight Wi-Fi primed for takeoff, Fierce Broadband Wireless (Feb. 9, 2012) (available at http://www.fiercebroadbandwireless.com/story/stat-market-flight-wi-fi-primed-takeoff/2012-02-09).

[19] *Allocation and Designation of Spectrum for Fixed Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz and 48.2-50.2 GHz Frequency Bands; Allocation of Spectrum to Upgrade Fixed and Mobile Allocations in the 40.5-42.5 GHz Frequency Band; Allocation of Spectrum in the 46.9-47.0 GHz Frequency Band for Wireless Services; and Allocation of Spectrum in the 37.0-38.0 GHz and 40.0-40.5 GHz for Government Operations, IB Docket No. 97-95*, Second Report and Order, FCC 03-296, ¶ 61 (rel. Dec. 5, 2003).

In its Petition, however, Qualcomm briefly considers and rejects the use of alternate spectrum, including the underutilized HAPS spectrum.[20] The Petition states that "bands above 16 GHz would be unsuitable due to higher equipment costs and the substantial challenge [of] rain attenuation," but Qualcomm provides no further justification for such a limit, nor does it give adequate consideration to other options such as the HAPS band.[21] For example, a possibility exists that rain attenuation could be addressed through the use of additional transmit power, larger receiver antennas, or ground station diversity, permitting an aircraft that is unable to communicate with one ground station due to rain fade to switch to an alternate station. The additional costs of such an approach may not exceed the costs of Qualcomm's proposed efforts to work around ubiquitously deployed and increasingly mobile satellite earth stations at 14 GHz.

In any event, a justification for rulemaking to adopt a new service should include justification for why the service is particularly suited to the specified band, even more so when the band in question is intensively used by existing services.

## III. CONCLUSION

Qualcomm's petition and supplementary information have not provided sufficient information for the industry or the Commission to evaluate accurately the risks of initiating a new ATG service in the 14.0-14.5 GHz band. Although the demand for ATG services is growing and the need for additional spectrum to meet this demand is clear, it is equally clear that to do so at the expense of existing and future services in the already crowded 14.0-14.5 GHz band would not serve the aviation industry or consumers.

[20] *Petition* at 19.

[21] *Id*.

Boeing therefore urges the Commission to not move forward with a rulemaking at this time because it would not be in the public interest and is premature in light of the information provided.

Respectfully submitted,

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